

N-Methylpyrrolidone (NMP)

N-Methylpyrrolidone (NMP) harms the developing fetus when tested in pregnant animals.

It is toxic to the reproductive system of male and female test animals. The reproductive effects of NMP have not been studied in humans. Based on the animal tests, you should treat NMP as a potential human reproductive hazard. Overexposure to NMP irritates the eyes, skin, nose, and throat. It can also affect the central nervous system or brain causing symptoms of drunkenness similar to the effects of drinking alcohol. NMP is easily absorbed through the skin. It is widely used to replace methylene chloride and other chlorinated solvents that harm the environment and health. HESIS revised this Health Hazard Advisory to inform workers and employers that Cal/OSHA has adopted a Permissible Exposure Limit for this substance.

**Health
Hazard
Advisory**

Products and processes that use NMP

NMP is a solvent (a liquid that dissolves solids). It is used for many different purposes.

NMP is used in:

- Painting (solvent), stripping or removing paint
- Removing graffiti
- Semiconductor manufacturing
- Silk-screen printing
- Construction adhesives and solvents
- Laboratory reagents
- Pharmaceutical solvents
- Polymer materials manufacturing
- Petrochemical solvents for extractions
- Insecticide, fungicide, and herbicide products

How NMP enters your body

NMP enters your body when it touches your skin, and when you breathe its vapors or droplets of spray in the air.

Your risk of health effects depends on the amount of NMP that enters your body. That depends mainly on the amount (the concentration) of NMP you breathe, how much touches your skin, and how long you are exposed to NMP.



Paint and paint strippers may contain NMP.

**HEALTH HAZARD
ADVISORY**



HESIS

HAZARD EVALUATION SYSTEM & INFORMATION SERVICE
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**This health hazard advisory is
an Information Alert from HESIS**

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California Department of Public Health • California Department of Industrial Relations

HOW NMP CAN AFFECT YOUR HEALTH

The toxic effects of NMP in humans have not been well studied. Most of the information comes from animal testing, not from human use of NMP. Animal tests are often used to determine effects of chemicals on human health.

REPRODUCTIVE SYSTEM

NMP caused delayed growth in the offspring of animals exposed during pregnancy in several studies. NMP also reduced fertility in male rats and increased the time for female rats to become pregnant.

The effects of NMP on reproduction have not been studied in humans. In one report, a worker's exposure to NMP during the first trimester of pregnancy was linked to abnormal growth of the fetus (intrauterine growth retardation) and stillbirth.

NERVOUS SYSTEM

NMP, like other organic solvents, can affect your brain. Breathing excessive amounts for a short period of time causes headache, nausea, dizziness, clumsiness, drowsiness, and other effects like those of being drunk. Drinking alcohol within a few hours of exposure increases these effects and makes them last longer, because the effects of alcohol and solvents add together. The symptoms of short-term exposure usually clear up within hours after exposure stops.

Repeated, frequent overexposure to NMP and other solvents over months or years can have long-lasting and possibly permanent effects on the nervous system. The symptoms of these long-term effects include fatigue, sleeplessness, poor coordination, difficulty in concentrating, loss of short-term memory, and personality changes such as depression, anxiety, and irritability.

EYES, NOSE, THROAT, AND SKIN

NMP is irritating to the eyes, nose, and throat. It is quickly absorbed into your body through your skin. NMP also dissolves the natural protective oils on your skin and can cause dermatitis (dry, rough, red, or cracked skin).

LIVER AND KIDNEYS

NMP is unlikely to cause liver or kidney damage if there is no noticeable effect on the nervous system. However, like other solvents, long-term exposure to NMP and drinking alcohol can increase your risk of liver damage.

CANCER

NMP did not cause cancer when tested in animals. It also did not cause genetic mutations in several tests.



Worker using NMP to clean electronics parts

HOW TO REDUCE YOUR EXPOSURE

By law, employers must provide a safe and healthy workplace using ventilation and other controls, and work practices to minimize your exposure to harmful chemicals such as NMP.

Cal/OSHA and the Cal/OSHA Consultation Service can help you and your employer – see “Where to Get Help” on the last page. Here are some ways employers and employees can work together to reduce exposures.

- ▶ **Substitution.** The best way to reduce exposure is to switch to products that do not contain NMP. Do not use products if you do not have safety data sheets (SDSs) and information on health hazards. Make sure you understand the health hazard information.

Switch to solvent-free products or use mechanical methods, such as wheat starch blasting, to remove paint and graffiti, when possible. If it is not possible to switch to solvent-free paint strippers, benzyl alcohol may be a safer substitute. Unlike NMP, benzyl alcohol does not cause reproductive and developmental damage in test animals. It also does not pose risks of cancer like methylene chloride does. Benzyl alcohol is absorbed through the skin. It may also cause allergic dermatitis. Water-based cleaners often can be substituted for products containing NMP and other toxic solvents like 1-bromopropane, for cleaning in the electronics industry and other industries.

If you cannot switch to products that are free of NMP or other solvents, take other steps to limit exposure.



- ▶ **Using Less.** Use as little as possible of solvent-containing products. Keep containers closed between uses.
- ▶ **Ventilation.** Make sure there is good ventilation. “Local exhaust ventilation” is most effective. It captures NMP vapors at the source before workers breathe them. In laboratories, fume hoods should be used. General ventilation using a fan-powered or heating, ventilation, and air conditioning (HVAC) system is the next best way to bring fresh air into the work area. Relying only on open doors and windows usually will not provide enough fresh air. Indoor fans that blow NMP-contaminated air around without removing it from the work area are not effective.
- ▶ **Respiratory Protection.** Cal/OSHA permits the use of respirators to control harmful exposures only if ventilation and other control methods are not effective or feasible. A half-face respirator with organic vapor cartridges can reduce exposure. In spraying operations, this should be combined with a mist pre-filter. A dust mask does not remove NMP vapors from the air and will not protect workers. Employers must comply with the Cal/OSHA Respiratory Protection Standard (Title 8, Section 5144). Requirements include making sure that respirators fit properly and workers are medically cleared to wear a respirator. See www.dir.ca.gov/title8/5144.html.
- ▶ **Skin Protection.** Wear chemical protective utility gloves such as butyl rubber or Silvershield® (laminated polyethylene/EVOH) when using products that contain NMP. NMP will go right through less durable gloves such as those made of natural rubber, nitrile, or polyethylene. Replace gloves often. Use chemical protective clothing such as aprons, sleeves, boots, and head and face protection if NMP can contact your skin at areas other than your hands. Clean the equipment thoroughly after each use. Cal/OSHA regulations require employers to supply gloves and any other necessary protective equipment. See www.dir.ca.gov/title8/sb7g2a10.html.

How to find out if you are working with NMP

Under California's Hazard Communication Standard, (Title 8, Section 5194), your employer must tell you if any hazardous substances are used in your work area, must train you to use them safely, and must make Safety Data Sheets (SDSs) available.

If you think you may be exposed to NMP on the job, ask to see the SDSs for the products you are using. The SDS for a product that contains NMP must identify it by the Chemical Abstract Services (CAS) number 872-50-4. You will find a list of some products that contain NMP on page 5.

SDSs describe the hazards of the product and protective measures users should take. Some SDSs do not fully describe the hazards of the product or protective measures. For more information on the Hazard Communication Standard, see www.dir.ca.gov/title8/5194.html.

Legal exposure limits

Cal/OSHA has a Permissible Exposure Limit (PEL) of 1 part per million (ppm) in air workers breathe. This limit is an 8-hour, time-weighted average. This exposure limit also has a skin notation, "S", indicating NMP may be easily absorbed into the bloodstream through the skin which contributes to the overall exposure. The Cal/OSHA PEL for workplace exposure to NMP may be found in Title 8, section 5155, "Airborne Contaminants", Table AC-1 (www.dir.ca.gov/title8/5155.html).

Measuring your exposure

The amount of NMP in the air in your workplace can and should be measured. In fact, Cal/OSHA regulations require your employer to measure exposure when workers may be exposed to concentrations of air contaminants in excess of the Permissible Exposure Limit.

Are there medical tests for exposure and health effects?

NMP and its major breakdown products, 5-hydroxy-N- methyl-2-pyrrolidone (5-HNMP) and 2-hydroxy-N- methylsuccinimide (2-HMSI) have been measured in the urine and blood of exposed workers and volunteers in several studies. The results compared well with air levels of NMP. The use of urine and blood tests for monitoring workplace exposure to NMP is still being studied.

If you work regularly with NMP or other hazardous substances, you should be given a complete physical exam, which includes a medical and work history, and periodic follow-up examinations.

Other regulations that help to protect workers

INJURY AND ILLNESS PREVENTION PROGRAM.

Every employer must have an effective, written Injury and Illness Prevention Program (IIPP). Major elements include: methods for identifying and quickly correcting workplace hazards; health and safety training; a health and safety communication system; and record-keeping. See www.dir.ca.gov/title8/3203.html.

ACCESS TO MEDICAL AND EXPOSURE RECORDS.

You have the right to see and copy your own medical records, and any records of toxic substance exposure monitoring in your work area. (Title 8, Section 3204). These records are important in determining whether your health has been affected by your work. Employers who have such records must keep them for at least 30 years after the end of your employment.

See www.dir.ca.gov/title8/3204.html.



DO YOU USE ANY OF THESE PRODUCTS?

These are some products with safety data sheets (SDSs) showing that they contain NMP. However, products like these can change their ingredients quite often. Be sure to check the current SDS for whatever products you are using.

► Paint Strippers and Graffiti Removers.

9051 Bio-Blast™ Bottom Paint Remover
Biostrip™
Citristrip™ Stripping Gel and Stripping Aerosol
Fast Adhesive Gun Cleaner
Franmar's Lead Out™ Paint Stripper
Kleen-Again™ Gun and Brush Cleaner
Peel Away™ 7
Ready-Strip™ Deck
Ready-Strip™ Marine
Ready-Strip™ Mastic Remover
Ready-Strip™ Pro
Ready-Strip™ Plus Safer Paint & Varnish Remover
Ready-Strip™ Spray
Soy-Gel™ Original, Spray, and Liquid
Soy-Strip™
Soy Strip Marine
Wash-Away™

► Pesticides.

Compel™ Insecticide
Decis™ 1.5EC Insecticide
Hoegrass™ 500 Selective Herbicide
Jaguar™ Selective Herbicide
Tigrex™ Selective Herbicide
Viper™ Herbicide



► Solvents, Cleaners, and Reagents.

K155 1-methyl-2-pyrrolidone biotech grade
Lyondell N-Methyl-2-Pyrrolidone
MX 1392 OmniSolv™
1-Methyl-2-Pyrrolidone
PI 2525, 2555, 2574 Dry etch
Safety-Kleen™ N-Methyl Pyrrolidone
TURCO™ 5668
X-GAL-IPTG Solution
M-Pyrol™
Pharmasolve™



WHERE TO GET HELP

- **HESIS** answers questions about NMP and other workplace hazards, and has many free publications available.

For information on workplace hazards (Toll Free in CA): **866-282-5516**. Please leave a message and your call will be returned.

For HESIS Publications (Toll Free in CA): **866-627-1586**. Call, or visit our website www.cdph.ca.gov/programs/ohb, or write to HESIS, 850 Marina Bay Parkway, Building P, 3rd Floor, Richmond, CA 94804.

- *HESIS Guide to Solvent Safety*. Discusses health and safety hazards and protective measures.
- *Workplace Chemical Hazards to Reproductive Health: A Resource for Worker Health and Safety Training and Patient Education*. Explains how chemicals can affect reproduction.
- *HESIS Publication List*. Fact sheets, booklets, and medical guidelines on workplace hazards including chemicals, repetitive motion, and infectious diseases. Visit our website, call, or write for the list.

- **Institute for Research and Technical Assistance (IRTA)** has information on safe alternatives for solvent-based products. Call **(323) 656-1121** or visit the IRTA website at www.irta.us.

- **California Division of Occupational Safety and Health (Cal/OSHA)** investigates workers' complaints, makes enforcement inspections, and answers questions about workplace health and safety regulations. Complainants' identities are kept confidential. Call the nearest Cal/OSHA district office to your workplace, which you can find at www.dir.ca.gov/DOSH/districtoffices.htm.

- **Other resources for employees** may include your supervisor, your union, your company health and safety officer, your doctor, or your company doctor.

- **Cal/OSHA Consultation Service** helps employers who want free, non-enforcement help to evaluate the workplace and improve the health and safety conditions. Employers can call **(800) 963-9424**. The Consultation Service also has free publications which can be ordered or downloaded at www.dir.ca.gov/DOSH/PubOrder.asp.

- **Occupational health services** can be found at:

- University of California (UC) San Francisco: (415) 885-7580
- UC Davis: (530) 754-7635
- UC Irvine: (949) 824-8685
- UC San Diego: (619) 471-9210
- UC Los Angeles: (619) 794-8144

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